

CLAIMS

We claim:

1. A method for forming a pattern in a resist film on a substrate by using a first mold provided with concave and convex portions, comprising the steps of:

5 (1) pressing the first mold onto the resist film to transfer the concave and convex portions of the first mold to the resist film, while heating the first mold to a predetermined temperature or after having heated the first mold to a predetermined temperature;

(2) separating the first mold from the resist film; and

10 (3) etching the resist film to expose a surface of the substrate.

2. The method according to Claim 1, wherein the pressing step is carried out so that a bottom of the concave portion avoids contacting with a surface of the resist film.

15 3. The method according to Claim 1 or 2, wherein a hardness of the first mold is higher than a hardness of the resist film.

4. The method according to any one of Claims 1 to 3, wherein the
20 predetermined temperature of the first mold in the pressing step is equal to or substantially equal to a glass transition temperature of the resist film.

5. The method according to any one of Claims 1 to 4, wherein the first mold comprises silicon or is formed by electroforming using the silicon as a master.

6. The method according to any one of Claims 1 to 5, wherein the resist film comprises a thermoplastic resin.

7. The method according to any one of Claims 1 to 6, wherein the etching step is carried out by reactive ion etching.

8. The method according to any one of Claims 1 to 7, wherein in a case where there are variations in a pattern density of a pattern to be formed in the resist film on the substrate by the first mold, the method comprises a pretreatment step in which the resist film is pressed in advance using a second mold so that a thickness of the resist film in a case where numerous regions pressed by the convex portions of the first mold exist is less than a thickness of the resist film in a case where few regions pressed by the convex portions of the first mold exist.

9. The method according to Claim 8, wherein the second mold in the pretreatment step is pressed onto the resist film while heating the second mold to a predetermined temperature or after having heated the second mold to a predetermined temperature.

10. The method according to Claim 8 or 9, wherein a hardness of the second mold is higher than a hardness of the resist film.

11. The method according to any one of Claims 8 to 10, wherein the predetermined temperature of the second mold in the pretreatment step is equal to or substantially equal to the glass transition temperature of the resist film.

12. The method according to any one of Claims 8 to 11, wherein the second mold comprises silicon or is formed by electroforming using the silicon as a master.

5 13. A method for forming a pattern in a resist film on a substrate by using a mold provided with concave and convex portions, comprising the steps of:

(a) arranging the mold on a vertically moving actuator;
(b) mounting the substrate on a sample base arranged in opposition to the actuator so as to oppose the mold;

10 (c) mounting the substrate on the mold;
(d) supporting the sample base having the substrate by a support; and
(e) moving the actuator so that the mold moves away from the resist film.

14. The method according to Claim 13, further comprising a step (f) of moving
15 the actuator so that the mold and the resist film make contact while heating the mold to a predetermined temperature or after having heated the mold to a predetermined temperature.

15. The method according to Claim 14, further comprising a step (g) of moving
20 the actuator so that the mold separates from the resist film.

16. The method according to Claim 15, further comprising a step (h) of etching the resist film to expose a surface of the substrate.

25 17. The method according to Claim 14, wherein the step (f) is carried out so

that a bottom of the concave portion of the mold avoids contacting with a surface of the resist film.

18. The method according to any one on of Claims 13 to 17, a hardness of the mold is higher than a hardness of the resist film

19. The method according to any one of Claims 14 to 17, wherein the predetermined temperature of the mold is equal to or substantially equal to the glass transition temperature of the resist film.

20. The method according to any one of Claims 13 to 19, wherein the mold comprises silicon or is formed by electroforming using the silicon as a master.

21. The method according to any one of Claims 13 to 20, wherein the resist film comprises a thermoplastic resin.

22. A pattern formation device for forming a pattern in a resist film on a substrate using a mold provided with concave and convex portions, comprising:

a sample base for mounting the substrate;

a first actuator arranged in opposition to the sample base for moving the mold;

at least two supports for supporting the sample base;

a second actuator arranged on the support for vertically moving the sample base; and

a monitoring unit for monitoring a contact between the support and the sample

base.

23. The pattern formation device according to Claim 22, wherein the monitoring unit monitors an amount of current flow by using the support and sample base as conductors and connecting a power supply therebetween.

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24. The pattern formation device according to Claim 23, wherein the power supply is an alternating current power supply.